Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3762]-29

S.E. (Mechanical) (Second Semester) EXAMINATION, 2010

METALLURGY

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answer Q. **1** *or* **2**, Q. **3** *or* **4**, Q. **5** *or* **6** from Section **I** and Q. **7** *or* **8**, Q. **9** *or* **10**, Q. **11** *or* **12** from Section **II**.

(*ii*) Answers to the two sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables, slide rule, scientific electronic calculator is allowed.

(*vi*) Assume suitable data if necessary, state clearly the assumptions you have made.

SECTION I

Unit I

1. (*a*) What are the various line defects in a crystal ? What is the effect of these defects on the properties of the material ? [6]

P.T.O.

(*b*) Why is a grain boundary irregular ? Why coarse grained material is preferred for high temperature applications ? [6]

(*c*) What do you understand by 'slip system' ? What is the relevance of slip systems with the ductility of material ? [4]

Or

2. (*a*) What is recrystallisation ? What are the factors that govern the recrystallisation temperatures ? [6]

(*b*) Differentiate between Hot working and cold working. [4]

(*c*) Draw the following plane and directions :

(010), (111), (100), [100], [121], [001]. [6]

Unit II

3. (*a*) Tensile test is conducted on steel specimen of diameter 11.58 mm and gauge length of 58 mm. The initial load at yield point is 69.6 kN. The maximum load taken by the specimen was found to be 77.2 kN. The gauge length and diameter at fracture were found to be 69.6 mm and 7.36 mm respectively. Find :

(*i*) Yield strength

(*ii*) Ultimate tensile strength

(*iii*) Percentage elongation. [6]

(*b*) Define the following terms :

(*i*) Strain hardening

(*ii*) Toughness

(*iii*) Fatigue limit

(*iv*) Yield strength. [6]

(*c*) Explain Magnetic particle test. [4]

Or

4. (*a*) Draw self explanatory sketches of the following :

(*i*) Stress strain diagram for mild steel

(*ii*) Creep test curve

(*iii*) Tension to tension stress pattern in fatigue. [6]

(*b*) Find true stress true strain, engineering stress and engineering strain of a low carbon steel which has the following test values :

Load applied to specimen = 65 kN

Initial diameter = 11.52 mm

Diameter of the specimen under the load of 65 kN = 9.68 mm. [6]

(*c*) Which non-destructive test will you recommend for the testing of the following ?

(*i*) Sorting of steel components of identical shape and size from mixed lot

(*ii*) Surface crack of a bearing sleeve

(*iii*) Circumferential surface cracks in round bar

(*iv*) Slag inclusion in a welded joint. [4]

Unit III

5. (*a*) Draw and label microstructure of the following plain carbon steels :

(*i*) 0.4% carbon steel, annealed

(*ii*) 0.8% carbon steel, annealed

(*iii*) Hypereutectoid, normalized [6]

(*b*) Slowly cooled plain carbon steel contains 50% ferrite and 50% pearlite at room temperature. Estimate the percent carbon present in the steel and determine the amount of total ferrite and cementite present in the alloy. [6]

(*c*) What is weld decay ? How can it be prevented ? [6]

Or

6. (*a*) What are the different types of transformation occurring on iron-iron carbide equilibrium diagram ? Write the general equation and give compositions of the reactants and products and the temperature at which they occur. [8]

(*b*) What are the various critical temperature lines observed in Iron-Iron carbide equilibrium diagram ? Explain the changes that occur at these temperatures. [6]

(*c*) Why alloying elements are used in steels ? Give *two* advantages of alloy steel over plain carbon steels. [4]

SECTION II

Unit IV

7. (*a*) What is hardenability ? What are factors that affect hardenability of steel ? [6]

(*b*) Explain the term Retained Austenite. What are the methods of eliminating Retained Austenite ? [6]

(*c*) What is induction hardening ? What should be the amount of carbon in steels that are to be induction hardened ? [6]

Or

8. (*a*) Why hardened steels are tempered ? What is tempering of steels ? Explain the various changes that occur during low, medium and high temperature tempering. [9]

(*b*) Write short notes on any *three* of the following :

(*i*) Stress relief annealing

(*ii*) Martempering

(*iii*) Flame Hardening

(*iv*) TTT Diagrams. [9]

Unit V

9. (*a*) Give composition, properties and uses of the following (any *three*) :

(*i*) Muntz metal

(*ii*) Gun metal

(*iii*) Beryllium Bronze

(*iv*) Alpha brass. [6]

(*b*) What is the effect of carbon, silicon and cooling rate on microstructure and properties of cast iron ? How are they controlled to obtain optimum properties ? [6]

(*c*) Why are the properties of SG iron superior to that of gray cast iron ? [4]

Or

10. (*a*) Explain how 'Malleable iron' is produced ? [6]

(*b*) Why is gray cast iron a suitable material for machine tool beds ? [6]

(*c*) What are the applications of pure aluminium ? How are aluminium alloys classified ? [4]

Unit VI

11. (*a*) What are the merits and limitations of Powder Metallurgy as a manufacturing process ? [6]

(*b*) Explain step-by-step manufacturing process of self lubricating bearing ? [6]

(*c*) Explain the principle of resistance temperature detectors. [4]

Or

12. Write short notes on (any *four*) :

(*a*) Powder manufacturing methods for use in Powder Metallurgy

(*b*) Segar cones

(*c*) Optical pyrometers

(*d*) Sintering

(*e*) Conditioning of metal powders. [16]